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abstract We discuss the origin of galactic angular momentum, and the statistics of the present day spin distribution. It is expected that the galaxy spin axes are correlated with the intermediate principal axis of the gravitational shear tensor. This allows one to reconstruct the shear field and thereby the full gravitational potential from the observed galaxy spin fields. We use the direction of the angular momentum vector without any information of its magnitude, which requires a measurement of the position angle and inclination on the sky of each disk galaxy. We present the maximum likelihood shear inversion procedure, which involves a constrained linear minimization. The theory is tested against numerical simulations. We find the correlation strength of nonlinear structures with the initial shear field, and show that accurate large scale density reconstructions are possible at the expected noise level.